

(12) UK Patent Application (18) GB (11) 2 288 301 (13) A

(43) Date of A Publication 11-10-1995

(21) Application No. 9406697.4

(22) Date of Filing 05.04.1994

(7)(1) Applicant(s)

Motorola Inc.

(Incorporated in USA - Delaware)

Corporate Offices, 1303 East Algonquin Road,  
Schaumburg, Illinois 60195, United States of America

## [72] Inventors

—Nicholas William Whinnett.

William Neil Robinson

Jonathan A. Stclair Globs

Anthony Patrick van den Heuvel

(74) Agent and/or Address for Service

Hugh Christopher Dunlop

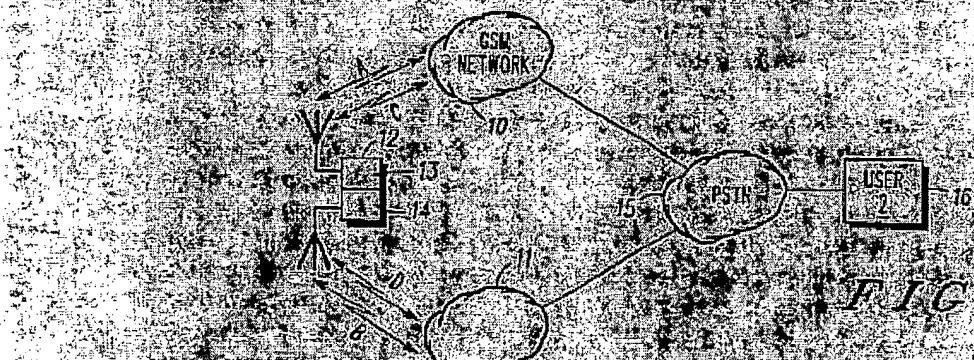
Motorola Limited, Europe

## Operation Jays Close, V

**BASINGSTOKE, Hampshire, RG22**

(54) Methods and apparatus for call handover between different mobile radio networks

(57) In a method for handing over a call from an initial communications network to a target communications network, a call is established between a mobile subscriber unit (12) and the initial communications network (10 or 11) using a first identification number allocated to that unit in the initial network. A desire to handover to the target network is identified and a new link in the target network (11 or 10 respectively) is established using a second identification number allocated to the unit (12) in the target network.



### FIG. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2288 301 A

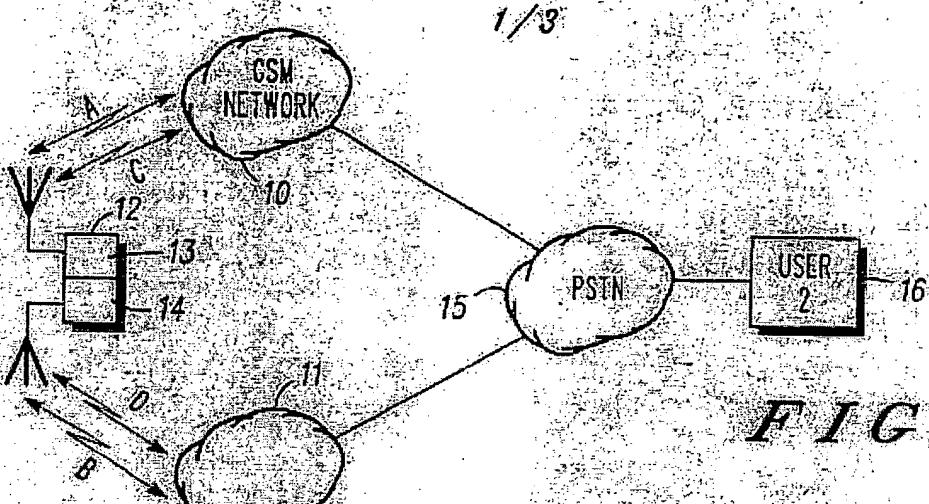


FIG. 1

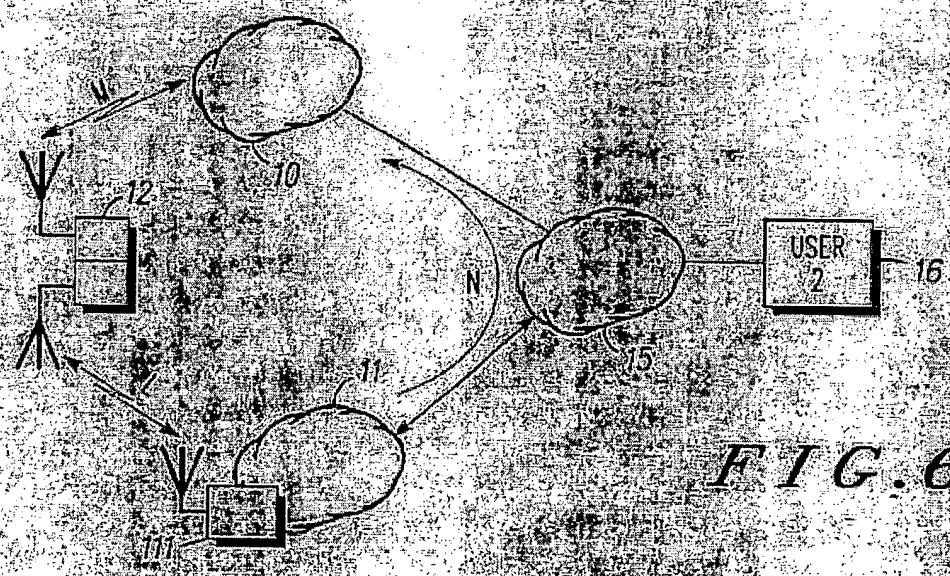


FIG. 6

2/3

FIG. 2

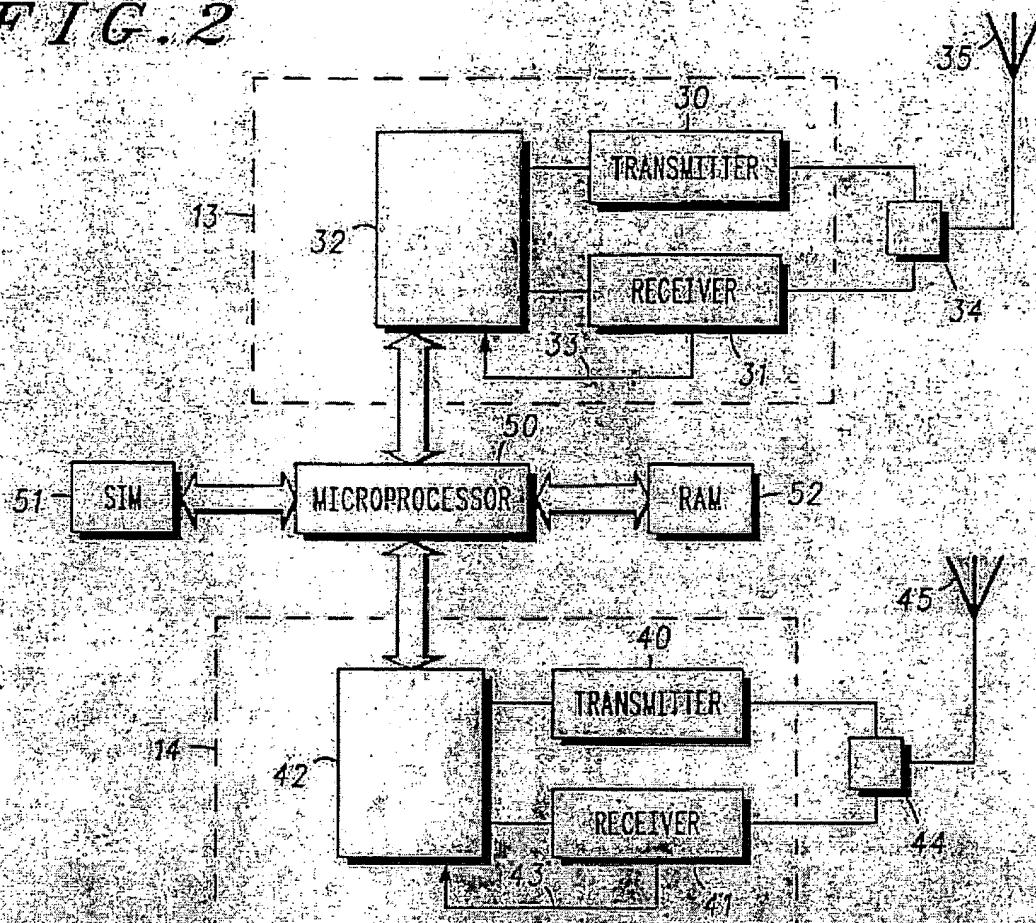
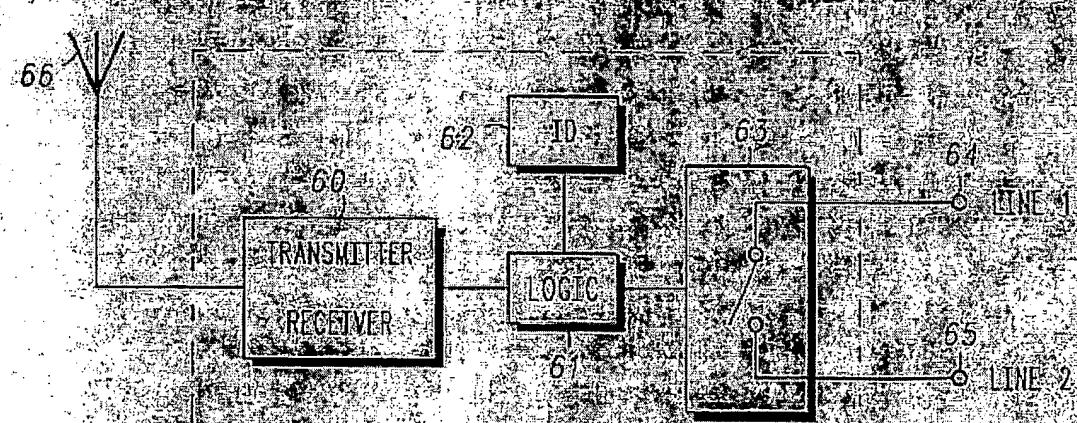


FIG. 5



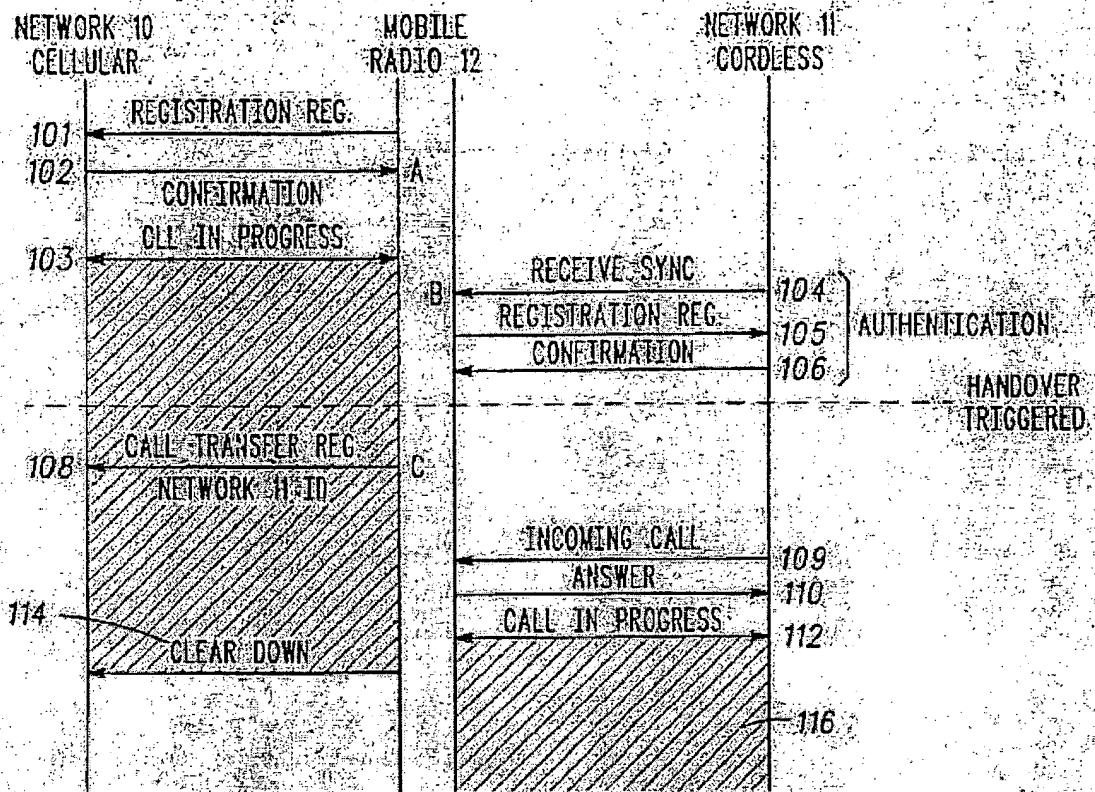
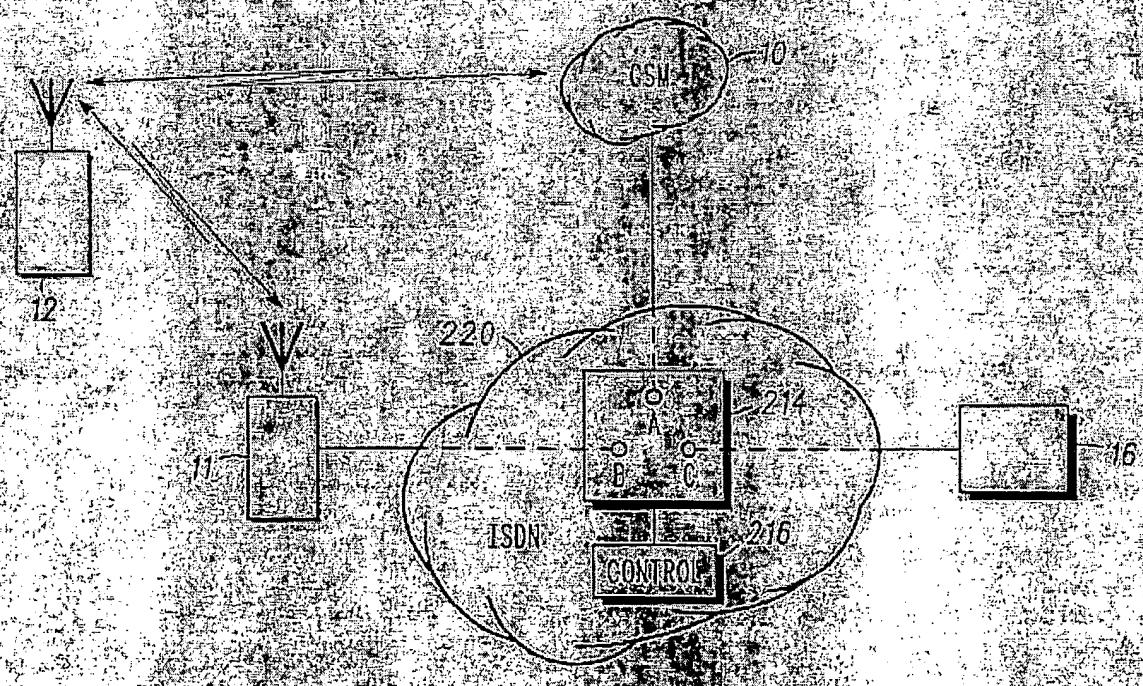


FIG. 3

FIG. 4



METHODS AND APPARATUS FOR CALL HANDOVER BETWEEN  
DIFFERENT MOBILE RADIO NETWORKS

Field of the Invention

5

This invention relates to the field of mobile radio and methods of inter-network call handover, for handing over a call from an initial communications network to a target communications network. It also relates to mobile radio apparatus.

10

Background to the Invention

15 The trend towards increasingly software configurable mobile radio units, together with the growing desire to support continuous uninterrupted service provision between communications systems or networks (eg. UPT, PCS, UMTS) makes the ability to continue a call when crossing network boundaries increasingly important.

20 Examples of such boundaries are between a public cellular operator and an indoor office wireless PABX, or between a public cellular network and a domestic cordless network, or between micro-cells and macro-cells supporting the same service provider.

Summary of the Invention

25 According to the present invention, a method of inter-network call handover is provided, for handing over a call from an initial communications network to a target communications network comprising the steps of establishing a call between a mobile subscriber unit and the initial communications network using a first identification number allocated to that unit in the initial network, identifying that a handover to the target network is desired and establishing a new link in the target network using a second identification number allocated to the unit in the target network.

30 The step of establishing the new link may comprise providing the initial network with the second identification number and initiating a request to establish a call to the unit in the target network using the second identification number.

35 Thus the invention provides simultaneous operation by a mobile unit on two networks and the automatic invocation of existing or new network

services to transfer the call, which gives rise to the benefit of call continuation with little disruption, which is a feature not available today.

The boundaries of a network are defined by its addressing domain. A unit or node that is able correctly to understand the addressing domain of a network is part of that network. The invention enables call handovers across these boundaries.

The request to establish a call to the unit in the target network is, in one embodiment, a call transfer request, that is to say a request to implement an operation by which an established (i.e. active) call is transferred to a third party, where the user served by the call transfer operation is either a called or a calling party. In this embodiment, the "third party" may appear to the initial network as a third party, while in fact the third party is the same mobile subscriber unit identified by a new identification number allocated to that unit in the target network.

To perform a call transfer, a known supplementary service defined by CCITT can be used.

In an alternative embodiment, the second identification number is pre-provided to a predetermined node in the initial network, for example a "home" base station or a cordless (i.e. short-range, dedicated or private-shared) base station, and the step of initiating a request comprises providing a signal from the mobile subscriber unit to the predetermined node requesting a handover to the mobile subscriber unit identified by the second identification number. This embodiment is particularly useful where a call is initially set up to or from the home base station or cordless base station and the subscriber moves away from that location while the call is in progress.

A benefit of this aspect of the invention is that the predetermined node can be established in a network which has lower call tariffs and the arrangement provides a mechanism for handing over from that network or to that network under the user's control, thereby enabling the user to take full advantage of the lower call tariffs.

The predetermined node should have two communications channels (e.g. telephone lines) in addition to its communications channel to the mobile subscriber unit. While the call is ongoing on one of these channels, the predetermined node can use the other channel to set up a path of communication to the target network, which in turn establishes radio communication with the mobile subscriber unit.

In a further aspect of the invention, a method of inter-network call handover, is provided, for handing over a call from an initial communications network to a target communications network, comprising the steps of:

establishing a call between a mobile subscriber unit and a second party via the initial communications network and identifying a calling identification number for the second party, identifying that a handover to the target network is desired, establishing a connection to the second party through the target network using the identified calling identification number of the second party and terminating the call established via the initial network.

5 To identify the calling identification number of the second party, standard calling party identification techniques can be used.

10 In accordance with this aspect of the invention, a mobile radio is also provided comprising transmitter-receiver means for selectively setting up calls with first and second radio communications networks, subscriber identification means for storing identification numbers for said first and second radio communications networks, control means for controlling said transmitter-receiver means and for supplying to said transmitter-receiver means said identification numbers for establishing calls on said networks selectively, storage means coupled to said control means and handover triggering means. The control means are arranged to store an identification number of a second party in said storage means when a call is established to that second party via one of said networks and, responsive to said handover triggering means, to recall said identification number and establish a call to the party identified by said number via the other of said networks.

15 In a yet further aspect of the invention, a method of inter-network call handover is provided, for handing over a call between a mobile communications unit and a second party from an initial communications network to a target communications network, comprising the steps of: 20 associating the mobile communications unit with a first identification number allocated to the mobile communications unit in the target network and with a predetermined node in the target network, establishing a call between a mobile subscriber unit and the initial communications network using a second identification number allocated to that unit in the initial network, establishing a communication path between the mobile subscriber unit and the predetermined node in the target network via the initial network, establishing a communication path between the predetermined node in the target network and the second party and linking at the predetermined node the two communication paths, identifying that a handover to the target network is desired, establishing a call to the mobile subscriber unit in the target network using the second identification number and connecting at the predetermined node the mobile subscriber unit and the second party.

As a further step, the communication path between the mobile subscriber unit and the initial network is preferably released, as is the communication path between the predetermined node and the initial network.

This aspect of the invention can be considered a corollary of the second embodiment of the first aspect of the invention, in that it is particularly applicable where the predetermined node is located in the target network, for example in the case where the predetermined node is a cordless base station, it is applicable to roaming inwards towards that base station.

Preferred embodiments of the invention will now be described, by way of example only, with reference to the drawings.

#### Brief Description of the Drawings

Fig. 1 illustrates two networks and a method of handover therebetween in accordance with a first embodiment of the invention.

Fig. 2 shows details of the mobile radio of Fig. 1.

Fig. 3 shows signals transferred between the mobile radio of Fig. 1 and the two networks of Fig. 1.

Fig. 4 gives a more specific example of the networks of Fig. 1 for the purposes of explanation of the signals of Fig. 3.

Fig. 5 illustrates two networks and a method of handover therebetween in accordance with a second embodiment of the invention.

Fig. 6 is a block diagram of a cordless base station operating as a hub in accordance with a third embodiment of the invention.

Fig. 7 illustrates two networks and a method of handover therebetween in accordance with the third embodiment of the invention.

#### Detailed Description of the Preferred Embodiments

The generic problem of handover between two networks is illustrated in Fig. 1.

In Fig. 1, two mobile radio networks are shown, 10 and 11. As an example, network 10 may be a cellular radio network, eg. GSM, and network 11 may be a domestic cordless system or a wireless PABX. Operating on these networks is a mobile radio 12 having GSM radio and software elements 13 and cordless radio and software elements 14.

The GSM radio and software elements 13 include a subscriber identity module with an identification number assigned to the mobile radio user by the operator of network 10 and the cordless radio and software elements 14 include an identification number assigned to the mobile radio user by the operator of network 11. These numbers are selected from the different addressing domains of the different networks 10 and 11.

The networks 10 and 11 are connected to each other via a third network 15, for example a public switched telephone network (PSTN) or an integrated digital services network (ISDN), which additionally connects networks 10 and 11 to second party equipment, for example a wireline telephone 16. Reference will be made in this description to the equipment 16 being a telephone, but it should be understood that equipment 16 could be almost any telecommunications destination, including a mobile radio telephone or a fixed or mobile data terminal.

Network 15 supports the supplementary service "Call Transfer", described in CCITT Volume III, Fascicle III.7, "Integrated Services Digital Network General Structure and Service Capabilities", Recommendations I.110-I.257 of November 1988.

From that document, the general principle of call transfer is as follows. The Call Transfer supplementary service is subscribed to by prior arrangements with the service provider. Subscription can be made for "Normal Call Transfer" and/or for either of the alternate procedures (ie. "Single Step Call Transfer" or "Explicit Call Transfer") offered by the service provider.

A served user, user X, can transform an established call with user Y into (effectively) a call from user Y to a third party, user Z. When the served user (user X) asks the service provider to begin the "Normal" Call Transfer, the service provider puts the already established call (with user Y) on hold. User X then proceeds to establish the second call (to user Z). Upon request from user X to complete the Call Transfer, the service provider would connect users Y and Z together while removing the connections between user X and the other two users.

In the resulting call Y to Z, user Z will have all the relevant characteristics of the called party, but user Y will not necessarily have all the characteristics of the calling party, depending on whether user Y called user X and also depending on which service or supplementary service is under consideration.

In some networks, user X can request completion of the Call Transfer either during or after the establishment of the connection to user Z.

The service provider will optionally notify users Y and Z of the transfer and, depending on interworking conditions and the supplementary services subscribed to by users Y and Z, will indicate to user Y the number of user Z and will indicate to user Z the number of user Y.

Normal call transfer is suitable for the purposes of the preferred embodiment of the present invention.

It is not necessary that the call transfer service is implemented in network 15. It can instead be implemented in network 10. Call transfer is a supplementary service which exists in many communications networks today, for example GSM, DECT and TETRA.

Details of the mobile radio 12 are shown in Fig. 2. The GSM radio elements 13 include a transmitter 30, a receiver 31 and baseband processing circuitry 32. A receive signal strength indicator (RSSI) 33 passes from the receiver 31 to the circuitry 32. A duplexer 34 connects the transmitter and the receiver to an antenna 35. The cordless radio elements 14 similarly include a transmitter 40, a receiver 41, baseband processing circuitry 42, an RSSI 43, a duplexer 44 and an antenna 45.

Controlling both the GSM radio elements 13 and the cordless radio elements 14 is a microprocessor 50 having random access memory 52 and having a releasably connected subscriber identity module (SIM) 51.

The SIM 51 contains separate identification numbers (IDs) for the GSM cellular radio system and the cordless system. Alternatively, two SIMs can be provided, or one SIM and one hard-wired ID or more than one hard-wired ID.

While the mobile radio is shown as having separate receivers and transmitters for the two mobile radio systems, the same hardware elements may be reusable for both systems, depending on the frequencies involved, the available switching times for switching between those frequencies and other factors.

Referring to Figs. 1 and 2 together, the case will now be considered where, for reasons of deteriorating signal quality as indicated by RSSI 33 (or some other quality measure), or merely reasons of differential call charges, the user of the mobile radio 12, while in communication with the second party 16 via networks 10 and 15, wishes to hand over to network 11 using the mobile radio's multimode capability. Such a handover/re-establishment can be triggered by a number of criteria or in a number of circumstances and the specific manner of triggering is not relevant to the present invention. For example, the handover can be manually triggered

when the user knows he has entered the range of the domestic cordless system 11.

The operation is as follows. Initially the mobile radio is communicating via system 10 (illustrated by arrow A). The mobile radio enters the range of network 11 and its cordless radio and software elements 14 identify signals from network 11 (arrow B) and complete any necessary registration procedures. The mobile radio decides to trigger a handover, or is instructed to trigger a handover. The mobile radio automatically sends a command to system 10 (arrow C) indicating a "Call Transfer" request to transfer to the user's network 11 address.

This call transfer request includes the user's network 11 ID (i.e. his PSTN telephone number in the case where network 11 is a cordless telephone network) retrieved from SIM 51.

In the case of a GSM-to-cordless transfer, the ID is sent through GSM layer 3. The GSM switch interprets the message and may negotiate with the PSTN about performing the transfer.

In the case of a cordless-to-GSM transfer, the PSTN recognises the GSM number and negotiates with the GSM network about performing the transfer.

The network 15 commences execution of the call transfer request to the requested address. Since this is an address in network 11, network 15 in effect establishes a communication path from telephone 16 to network 11 (arrow D). Network 11 indicates to the mobile radio 12 that there is an incoming call for the mobile radio. The mobile radio automatically accepts the call from network 11 and the call between the mobile radio and network 10 is dropped.

An advantage of the arrangement is that no changes to the network are required to enable the handover. All of the new functionality is implemented in the mobile radio 12.

The above procedure is described in more detail with reference to Figs 3 and 4. In the example of Fig. 4, network 15 is an ISDN network and is referred to as network 220. Network 220 has a network switching function 214 with switching control function 216.

The mobile radio 12 registers with the cellular system (network 10) by means of an exchange of signalling messages 101 and 102 (Fig. 3).

Additional signalling messages may be exchanged at this time, for example to perform mobile authentication, as may be done in GSM. A call is initiated on network 10 in step 103 using the protocols of network 10 between second part equipment 16 and mobile radio 12 (Fig. 4). During this

phase of the call, points a and c are connected in the network switching function 214.

The mobile radio 12 may handover between cells of network 10. At some point during the call, the mobile acquires and registers with network 11 (steps 104, 105, 106). The mobile radio then sends a call transfer request to network 10 which contains the identification number allocated to the mobile radio unit in network 11. This is passed to the switching control function 216 of public network 220. The switching control function signals from node b to network 11 that there is an incoming call. Network 11 in turn pages the mobile radio (step 109) and the mobile radio responds (step 110). At this point, the switching function 214 connects nodes a and b and may suspend the connection between nodes a and c. The mobile radio then sends a "Clear Down" message 114 to network 10. At this point the switching function, under the control of the control function, connects nodes b and c and the call continues (116).

Many situations can be considered where the method described is useful. For example a farmer with a cordless telephone system in his farmhouse may commence a call in the vicinity of his farmhouse and walk into his field, out of range of the cordless system. Provided that the farm is covered by a much larger cell of a cellular radio telephone system and the farmer has subscribed to that system, the call can be continued via the cellular system.

As an alternative to "Call Transfer", the supplementary service "Call Waiting" can be used to implement inter-network handover.

Call Waiting is also described in CCITT Volume III, Fascicle III-7.

For the implementation of this method it is necessary that the identity of the second party is known to the user of the mobile radio. This is the case if the call is initiated at the mobile radio or the call is initiated at the second party and calling party identification is available. It is further necessary for the second party to have the "Call Waiting" feature.

The method will be described with reference to Figs. 2 and 5. In this figure, the same elements as are present in Fig. 1 are shown with the same reference numerals.

In operation, a call is set up between the mobile radio 12 and the telephone 16. This is illustrated by arrows G and H. At the time of setting up of this call, the telephone number of the second party (user 2) is stored in RAM memory 52 in the mobile radio 12. Storage of this number is initiated either by keying in the number at the mobile radio 12 (in the case of an outgoing call) or by microprocessor 50 extracting from baseband processing

circuitry 32 the telephone number of the calling party at the time of call set-up when that number is identified to the baseband processing circuitry 32 through calling party identification (in the case of an incoming call).

During the call, network 11 is identified by mobile radio 12 and a handover requirement is triggered (as before). The telephone number previously stored is retrieved from memory 52 and passed by microprocessor 50 to baseband processing circuitry 42 and a simultaneous call is automatically made to the second party (arrows J and K). The telephone 16 receives a call waiting indication from network 15. The second party, using telephone 16 manually selects the new call and the mobile radio drops the call from network 10.

The method described can be modified in a number of ways. For example, the second party equipment 16 can have two telephone lines 20 and 21 as shown, in which case the selection of the second call by the second party using telephone 16 can be executed manually or made automatic within the equipment 16, rather than relying on the call waiting service within network 15.

For example, if telephone 16 has a look-up table correlating the mobile user's network 10 ID and his network 11 ID, telephone 16 is in a position to identify that the waiting call is in fact from the same party as the call in progress and can then automatically choose to put the new call through to its handset. This intelligence can, of course, be located in network 15.

As an alternative, telephone 16 could actually compare the audio signals on the two lines 20 and 21 and identify a correlation between them and select the new call when the correlation is sufficiently high to identify that the two conversations are the same.

In a further, and in fact preferred, alternative the mobile subscriber unit 12 drops the call from network 10 and defaults to network 11.

A third method of achieving inter-network call handover is now described, in which all calls are routed through a central hub or predetermined node.

In this method, all calls to and from a mobile radio always pass through a common point or 'central hub' regardless of which network the mobile radio is using. This central hub must be capable of setting up a simultaneous call to an address on another network.

An example of a central hub in the form of a cordless base station is shown in FIG. 6. It comprises a cordless base station transceiver part 60, logic circuitry 61, storage 62 (for storing the user's GSM ID, switch and line

control circuit 63 and first and second telephone lines 64 and 65. An antenna 66 is connected to the transceiver part 60.

An example of operation will be described with reference to Fig. 7. In this example, network 11 (or a predetermined node of network 11) is the central hub. Network 11 is, at least in the preferred embodiment, a domestic cordless telephone base station (illustrated as base station 111) with a two-line connection into the PSTN (network 15). All calls pass to and from the mobile 12 through cordless telephone base station 111.

Considering first the case where the mobile radio 12 commences operation (arrow L) within range of the cordless base station 111 and moves out of range of that system but within range of the GSM cellular system 10 (arrow M). When the need for a handover is identified, the mobile radio 12 recognises GSM system 10 and executes a registration procedure on that system (if not already executed) and it informs the cordless base station 111 that a handover to system 10 is requested and it supplies to the cordless system its GSM cellular telephone number (or this is pre-programmed in the cordless base station). The cordless base station 111 calls the user's cellular telephone number (arrow N). The mobile radio 12 automatically accepts the call from the cellular system. The previous cordless link between the mobile subscriber unit 12 and base station 111 is disregarded. In a simple system, it is not necessary to "hang up" from the cordless system; the cordless base station merely ignores traffic on its radio interface until a handover back to the cordless system is desired.

For the process of handing over from network 10 to network 11, the following procedures take place.

Considering first the case of a mobile initiated call. The mobile unit initiates such a call by first dialling the central hub, which then places a second call to the desired number which is supplied by the user. This process may be automated within the mobile subscriber unit 12. Since the call has been routed via the cordless base station 111, when the mobile unit comes into range of the cordless base station 111, registration occurs and the base station 111 automatically delivers the call to the mobile radio 12 using the cordless link (arrow L). The cellular telephone call (arrow M) is dropped from the cellular system 10 by the mobile or by the base station 111.

As a refinement to the method, to avoid inefficient call routing, the call may only be placed via the cordless base station 111 if the identity of the cellular network or a sub-network of cellular network 10 is such that a

handover to cordless base station 111 is likely, e.g. because the call is set up in a cellular radio network cell that is known to be the user's "home" cell.

In the case of incoming calls to the mobile radio 12, to enable handover, all calls must be routed via the cordless base station 111. The cordless base station 111, upon receiving an incoming call when the mobile radio 12 is not in the range of the cordless base station 111, sets up a connection to the mobile radio via the cellular network 10 using the mobile radio's cellular identity and connects the incoming call to the cellular connection. Handover will then occur in the same way as for mobile initiated calls.

This arrangement has the advantage that the mobile radio user need provide callers with only a single telephone number for the user to be reached in either system. This number will be the address of the central hub or node of that user in system 11. All routing of calls to the user via the other system 10 is performed by this central hub or node.

Claims

1. A method of inter-network call handover for handing over a call from an initial communications network to a target communications network, comprising the steps of:

establishing a call between a mobile subscriber unit and the initial communications network using a first identification number allocated to that unit in the initial network,

10 identifying that a handover to the target network is desired and

establishing a new link in the target network using a second identification number allocated to the unit in the target network.

15 2. A method according to claim 1, wherein the step of establishing the new link comprises providing the initial network with the second identification number and initiating a request to establish a call to the unit in the target network using the second identification number.

20 3. A method according to claim 2, wherein the request is a call transfer request.

25 4. A method according to claim 2, wherein the second identification number is pre-provided to a predetermined node in the initial network and the step of initiating a request comprises providing a signal from the mobile subscriber unit to the predetermined node requesting a handover to the mobile subscriber unit identified by the second identification number.

30 5. A method according to claim 4 comprising the initial step of establishing a communication path between the predetermined node and a second party, wherein the predetermined node establishes a communication path to the mobile subscriber unit via the target network, maintains the communication path to the second party and links the two communication paths.

35 6. A method according to either of claims 4 and 5, wherein the predetermined node is a base station.

7. A method of inter-network call handover, for handing over a call from an initial communications network to a target communications network, comprising the steps of:

establishing a call between a mobile subscriber unit and a second party via the initial communications network and identifying a calling identification number for the second party.

identifying that a handover to the target network is desired.

establishing a connection to the second party through the target network using the identified calling identification number of the second party and

15 terminating the call established via the initial network.

8. A method according to claim 7, wherein the connection to the second party through the target network is established with a call waiting procedure prior to terminating the call established via the initial network.

26

9. A method of inter-network call handover, for handing over a call between a mobile communications unit and a second party from an initial communications network to a target communications network, comprising the steps of:

5

associating the mobile communications unit with a first identification number allocated to the mobile communications unit in the target network and with a predetermined node in the target network;

10

establishing a call between a mobile subscriber unit and the initial communications network using a second identification number allocated to that unit in the initial network;

15

establishing a communication path between the mobile subscriber unit and the predetermined node in the target network via the initial network;

establishing a communication path between the predetermined node in the target network and the second party, and linking, at the predetermined node, the two communication paths;

20

identifying that a handover to the target network is desired;

establishing a call to the mobile subscriber unit in the target network using the second identification number, and

25

connecting, at the predetermined node, the mobile subscriber unit and the second party.

30

10. A method according to claim 9, comprising the further step of disconnecting the call between the mobile subscriber unit and the initial communications network.

11. A method according to claim 9, wherein the predetermined node is a cordless base station.

12. A mobile radio comprising:

transmitter-receiver means for selectively setting up calls with first  
and second radio communications networks;

5 subscriber identification means for storing identification numbers for  
said first and second radio communications networks;

control means for controlling said transmitter-receiver means and for  
supplying to said transmitter-receiver means said identification numbers for  
establishing calls on said networks selectively;

10 storage means coupled to said control means and

handover triggering means

wherein the control means are arranged to store an identification  
number of a second party in said storage means when a call is established to  
that second party via one of said networks and, responsive to said handover  
triggering means, to recall said identification number and establish a call to  
15 the party identified by said number via the other of said networks.

Relevant Technical Fields		Search Examiner MR N HALL	
(i) UK Cl (Ed 10)	H4L (LDSD), H4K (KY4D14H, KY4D14R)		
(ii) Int Cl (Ed 5)	H04Q 7/04	Date of completion of Search 28 OCTOBER 1994	
Databases (see below)		Documents considered relevant following a search in respect of Claims 7 AND 11	
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.			
(ii) ON-LINE: WPI			
Categories of documents			
X:	Document indicating lack of novelty or of inventive step.	P:	Document published on or after the declared priority date but before the filing date of the present application.
V:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	R:	Member of the same patent family, corresponding document.
Category	Identity of document and relevant passages		Relevant to claim(s)
A, E	EP 0605120 A1 (AT & T)		

**Databases:** The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

Patents Act 1977  
Examiner's report to the Controller under Section 17  
(The Search report)

Application number  
GB 9406697.4

Relevant Technical Fields

(i) UK Cl (Ed. M) H4L (LDSD); H4K (KY4D14H, KY4D14R)  
(ii) Int Cl (Ed.5) H04Q 7/04

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.  
(ii) ON-LINE: WPI

Search Examiner  
N W HALL

Date of completion of Search  
14 JUNE 1994

Documents considered relevant  
following a search in respect of  
Claims  
1 TO 6, 12

Categories of documents

X: Document indicating lack of novelty or of inventive step.  
Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.  
A: Document indicating technological background and/or state of the art.  
P: Document published on or after the declared priority date but before the filing date of the present application.  
E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.  
&: Member of the same patent family, corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
Y	EP 0344989 A2 (TOSHIBA) whole document	1, 12 at least
Y	US 5063591 (JODOIN) whole document	1, 12 at least
Y	US 4833701 (COMRUE) whole document	1, 12 at least
*X	GB 2271040 A (MOTOROLA) see Claims 1, 2	1, 12 at least
*Document cited after issue of Search Report		

Databases. The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journals (Patents). The on-line databases considered for search are also listed periodically in the Official Journals (Patents).

### Relevant Technical Fields

(i) UK CI (Ed. M) H4L (LDSD), H4K (KY4D14H, KY4D14R)  
(iii) Int CI (Ed. 5) H04Q 7/04

### Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(i) ON-LINE: WPI

Search Examiner  
N. W. HALL

Date of completion of Search  
14 JUNE 1994

Documents considered relevant following a search in respect of Claims.

### Categories of documents

X:	Document indicating lack of novelty or of inventive step.	P:	Document published on or after the claimed priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	&	Member of the same patent family, corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
Y	EP 0344989 A2	(TOSHIBA) whole document	1, 12 at least
Y	US 5063591	(IODOIN) whole document	1, 12 at least
Y	US 4833701	(COMROE) whole document	1, 12 at least

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

**BLACK BORDERS**

**IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**

**FADED TEXT OR DRAWING**

**BLURRED OR ILLEGIBLE TEXT OR DRAWING**

**SKEWED/SLANTED IMAGES**

**COLOR OR BLACK AND WHITE PHOTOGRAPHS**

**GRAY SCALE DOCUMENTS**

**LINES OR MARKS ON ORIGINAL DOCUMENT**

**REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**

**OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**